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PHYSIOCHEMICAL EVALUATION OF TETRA-PACK APPLE JUICES AVAILABLE IN QUETTA, PAKISTAN.

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Abstract:

Many brands produced fruit juices in different packaging like plastic bags, glass bottles and tetra packs to control the post harvesting loss. Some brands do not follow the rules and regulations regarding food quality and produce products harmful to human health. The current study was also based on examining and observing the tetra pack apple juices to check the food quality assurance and their physicochemical parameters. Moisture contents, ash, acidity, organic and inorganic content, crude fibers, pH, vitamin C, and carbohydrates by method reported in AACC and AOAC methods. The percentage of Moisture was highest as compare to the standard parameters in samples II, IV, VI, and VIII, (96.38%, 94.42%, 93.45%and 92.64%). The ash content was ranged from (0.05-0.12%). pH values high in samples IV, II, III. (3.70%,3.64%,3.22%,) while higher acidity was found in samples IV, VII, VIII, II (0.23%,0.20%,0.18%,0.15%), the pH and acidity were greater with compare to the standard values. Mostly protein contents were not in maximum range in juices while in our results maximum protein content was found in apple juice sample VII, (0.14%). Ascorbic acid was found higher from standard range in samples V, VIII, (11.8, 11.0mg/100g). All samples of apple juice have total sugars in a range of (6.2-10.2%), reducing sugars found in samples ranges of (2.7-5.3%), while non-reducing sugars were found in a range of (3.3-4.9%) which meet the standard range of tetra pack juices.

Key Words; Tetra Pack Juices, Apple Juice, Physicochemical parameters, Ascorbic Acid

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Introduction:

The fruits of Baluchistan are included in the natural resources of Pakistan. In Baluchistan, 149,726 hectares of areas is covered by fruit crops. About 1million tons of fruit production is successfully achieved every year, and 34% of fruits are apples. Over thousands of tons of apples are exported from Baluchistan annually. Around 80% of the best apple production is in Baluchistan (Shah *et al*., 2011). It requires perfect processing to control post harvesting loss. It is a delicious fruit with high nutritional values, e. g, vitamin C, A, B, carbohydrates, proteins, and fat in balanced quantities. While the jam, jellies, candied fruit, juices and purees production safe its nutritional quality (Boyer and Ruilin, 2004). It consists of antioxidants and fiber contents (Pisoschi and Negulescu, 2011). The antioxidant property,

balanced calorific values and the prevention of re- absorption are the protective source against several chronic diseases (Raman et al. 2016; Kim & Byzova 2014), for controlling cancer, cholesterol, heart diseases, and weight loss (SSC, 2008). The food law and authorities work to maintain the nutritional quality of juice and introduce several packaging (IM. Food Laws manual) while, some brands do not follow the rules and regulations which are dangerous to human health and cause diarrhea, paralysis, hepatitis, high blood pressure, mental disturbance, and cancer. It is necessary to check the food contamination in food products to overcome the health problems (Dosumu et al., 2009). The modern packaging of juices based on cheap and disposable materials which are easy to purchase and use (Marsh and Bugusu, 2007). The different nutritional values of fruit juices change during the processing of fruit juice concentration (Lee and Sohn, 2003). As fruit juice concentrate is the chief constituent in preparing many juices (Hong and Wrolstad, 1990).

The current study was planned to analyze various Physicochemical parameters such as pH, acidity, sugar content, vitamin C content, ash value, organic and inorganic content in the tetra pack apple juices. These parameters are crucial in determining the overall quality and safety of food products, as they can indicate the freshness and nutritional value of apple juices available in market.

Methodology:

Apple juices packed in tetra packs of different brands were purchased from the local market of Quetta city. These samples were physically analyzed for sensory evaluation and chemically analyzed for nutritional composition in the Biochemistry laboratory, SBK Women's University, Quetta. The physical characteristics like color, odor, and taste were analyzed by Larmind method (Prynne, et al, 2006). While the chemical composition of samples was analyzed for Moisture contents, ash, total organic and inorganic content by AACC method, acidity and vitamin C estimated by AOAC method, the pH was recorded by digital pH meter. The meter calibration was done by using commercial buffer solutions at pH 6.8, 4.0 and 10. apple juice was inserted with a pH electrode and pH was recorded after stabilization. The modified standard method of Ruck was applied for the investigation of total and reducing sugars (Ruck, 1969). All tests were performed in duplicate. Results were produced in %age. Mean, standard error was calculated in excel and graphs were generated.

Results:

The results of the investigated nutritional values are given in Table 1. Moisture percentage was marked highest from standard range in samples IV, VI, II, and VIII (96.38%, 94.42%, 93.45%and 92.64%)

moderate in samples III, VII (90.56%,90.88%) and lowest in sample I and V (89.80% and 87.39%). Maximum moisture content significantly affects juice flavor; therefore, products having higher moisture content relatively have less shelf life. All samples showed maximum level of organic content (99.92-99.9%). The highest level of ascorbic acid was found in samples V, VIII of apple juice, (11.8, 11mg/100g). In contrast, sample I shows the lowest ascorbic level (8.6mg/100g). Samples VII, III, VI, II, IV are found to have a moderate level of ascorbic acid in a range (10.8-8. 96 mg/100g). Vitamin C (ascorbic acid) is the main ingredient of fruits. It helps to protect the fruit juices from microorganism's growth. Results are depicted in Fig. 1.

Ash %illustrated organic and inorganic contents found in juices. The ash content of given apple juice samples was ranged from (0.05-0.12%). Highest ash contents are present in sample 5 (0.12%) samples I, VII found to have same ash content (0.10%) and samples II, III, IV, VIII (0.07%, 0.09%, 0.04%, 0.08%) respectively, lowest ash content was found as the standard parameters in sample VI (0.05%). pH was determined by pH meter and recorded in the range from 2.90-3.70%. Higher acidity found in samples IV, VII, VIII, II (0.23%, 0.20%, 0.18%, 0.15%) respectively, samples III and VI have same acidic value (0.11%) and low in sample V, I (0.12%,0.10%) respectively. Protein is the vital constituent of all foods. Results indicate an insufficient amount of protein in apple juice. A high rate of protein content was found in apple juice sample VII (0.14%) and 0.1% in samples I, II, V, VIII, while samples III, VI, and IV were found in the range from 0.11 to 0.12%. results are showed in Fig.2.

Sugar plays a vital part in the process of fermentation. According to the results, all samples of apple juice have total sugars in 6.2-10.2%. The maximum level of total sugar is found in sample I, (10.2%). Samples VII, IV, II, III, VI, V, had total sugars (9.1%, 8.4%, 7.8%, 7.5%, 7.4%, 6.8%) respectively, minimum level was found in sample VIII (6.2%). According to the results reducing sugars found in samples ranges of (2.7-5.3%), while non-reducing sugars were found in (3.3- 4.9%). The highest level of reducing sugar was found in samples I (5.3%), followed by samples VIII, IV (4.8%, 4.0%) respectively. In contrast, sample V has the lowest reduction level (2.7%). The maximum level of non-reducing sugar was found in samples I (4.95%) followed by samples VI, III (4.6 and 4.5%) respectively the same level of non-reducing sugar is found in samples II, IV (4.4%) minimum level was in sample VIII (3.3%). Results are shown in Fig.3.

Another essential constituent of fruit juices is crude fibers. As result shows that only three given samples of apple juice I, III, V contain very fewer amounts of crude fiber, (0.1%), while fiber content was absent in the remaining samples.

Table 1. Physio chemical parameters and nutritional composition of tetra pack Apple juices of Quetta city

PARAMETERS	SAMI Mean ±Std. D	SAMII Mean ±Std. D	SAMIII Mean ±Std. D	SAMIV Mean ±Std. D	SAMV Mean ±Std. D	SAMVI Mean ±Std. D	SAMVII Mean ±Std. D	SAMVIII Mean ±Std. D
Moisture%	89.8 ±0.14	93.45 ±0.71	90.56 ±0.35	96.38 ±0.27	87.39 ±0.08	94.42 ±0.06	90.88 ±0.02	92.64 ±0.07
Organic Content%	99.9 ±0.01	99.93 ±0.66	99.91 ±0.29	99.96 ±13.79	99.88 ±0.69	99.95 ±0.67	99.9 ±0.36	99.92 ±0.01
Ascorbic Acid (mg/100g)	8.6 ±0.85	9 ±0.85	10.1 ±1.06	8.9 ±0.85	11.8 ±1.41	9.6 ±1.56	10.8 ±1.27	11 ±2.12
pH	3.14 ±0.04	3.64 ±0.03	3.22 ±0.01	3.7 ±0.07	3.21 ±0.01	2.96 ±0.31	3.1 ±0.14	2.9 ±0.14
Acidity%	0.1 ±0.02	0.15 ±0.02	0.11 ±0.01	0.23 ±0.01	0.12 ±0.03	0.11 ±0.03	0.2 ±0.01	0.1 ±0.03
Ash%	0.1 ±0.02	0.07 ±0.03	0.09 ±0.03	0.04 ±0.03	0.12 ±0.3	0.0 ±0.3	0.1 ±0.03	0.08 ±0.01
Inorganic Contents%	0.1 ±0.02	0.07 ±0.03	0.09 ±0.03	0.04 ±0.03	0.12 ±0.03	0.05 ±0.03	0.1 ±0.03	0.08 ±0.01
Crude Protein (%)	0.1 ±0.01	0.1 ±0.04	0.12 ±0.03	0.11 ±0.02	0.1 ±0.02	0.12 0.02	0.14 ±0.01	0.1 ±0.01
Crude Fiber (%)	0.1 ±0.03	NIL	0.1 ±0.01	NIL	0.1 ±0.02	NIL	NIL	0.1 ±0.01
Total Sugars (%)	10.2 ±0.28	7.8 ±0.28	7.5 ±0.42	8.4 ±0.42	6.8 ±0.28	7.4 ±0.28	9.1 ±0.14	6.2 ±0.28
Reducing Sugars (%)	5.3 ±0.42	3.4 ±0.57	3 ±0.28	4 ±0.28	2.7 ±0.28	2.8 ±0.21	4.8 ±0.42	2.9 ±0.21
Non Reducing Sugar (%)	4.8 ±0.21	4.4 ±0.81	4. ±0.29	4.4 ±0.57	4.1 ±0.28	4.6 ±0.29	4.3 ±0.28	3.3 ±0.21

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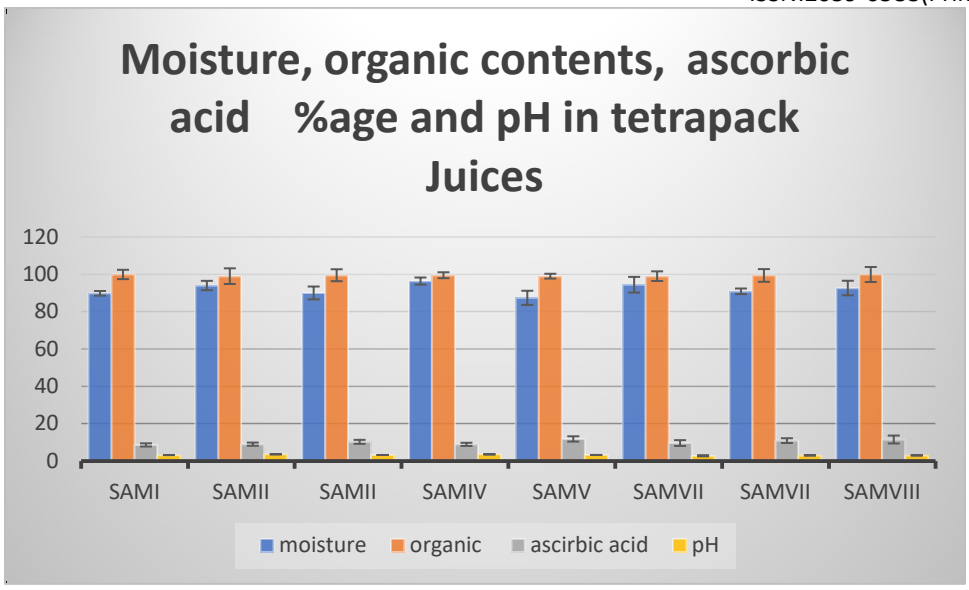

Fig. 1. Comparison of Moisture content, organic content, Ascorbic acid and pH of Apple Juices.

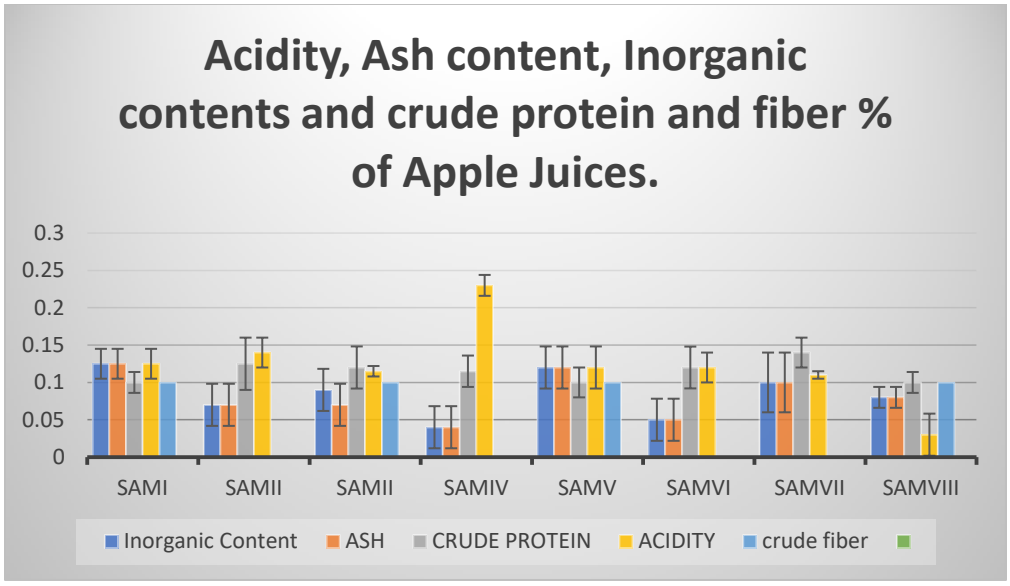

Fig. 2. Comparison of Acidity, Ash content, Inorganic contents and crude protein of Apple Juices.

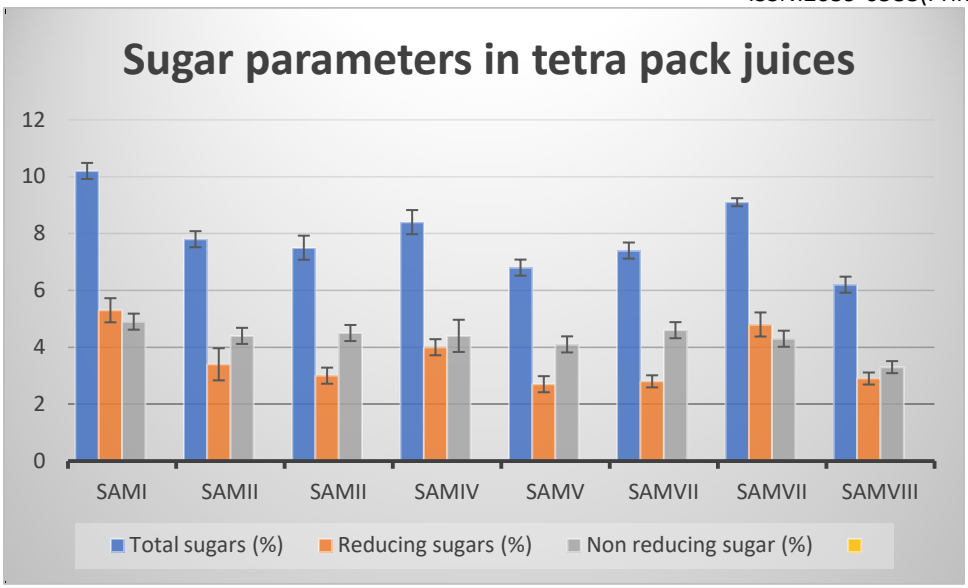

Fig. 3. Comparison of total sugars, Reducing sugars and Non-reducing sugars of Apple Juices.

The sensory evaluation's results are given in Table 2. The difference in the sensory character of various brands of commercial tetra pack apple juice for color, odor, taste and flavor according to the quality of substance, ingredients and process of their production. The judges passed out the acceptability for the Sensory evaluation of the selected samples.

Table 2 review the results of sensory evaluation of various brands of commercial tetra pack apple juices. The color of the juice samples is a very main factor. According to the results, the score obtained for color from 5- 8. Sample VII was in category 8, which explained that the color of the juice was strong according to the required parameters. According to the results score obtained for the odor of these tetra pack juices were fall in different categories from 6-9. Sample II was in category 9, which shows that the odor of the juice was extremely like according to the required parameter. The third most important factor in sensory evaluation is taste. Results indicate that scores obtained for the taste of these tetra pack juices were fell in different categories from 6-8. Samples II and VI are found to be present in category 8, which means juice has a strong taste. The fourth factor is flavor categories from 6-9. Samples VI, VII were in category 9, which explain the extreme flavor of juice sample.

Table2: Sensory Evaluation of Selected Tetra Packs Apple Juices of Quetta city.

Parameter	SAMI	SAMII	SAMIII	SAMIV	SAMV	SAMVI	SAMVII	SAMVIII
Color	7	7	6	5	7	6	8	5
odor	8	9	7	6	6	6	6	7
Taste	7	8	6	7	7	8	7	7
Flavor	6	7	8	8	6	9	9	8
Overall Acceptable	8	9	8	8	7	9	9	8

1=Most dislike, 2= More dislike, 3= dislike, 4= less dislike, 5=Normal,
6=less like, 7= like, 8=More like, 9=Most like.

Discussion:

Awolu et al., (2013) reported that the main constituent of apple juice is water which accounts for 70-97% of juice. Mehboob et al., (2023) reported moisture content in fresh and packed apple juices (97.02% and 91.65%) respectively. Results of current study showed moisture content ranges from (90.56- 96.38%). The pH value of juices can be varied by the variety, date of apple harvest, the method of gaining and also method of processing of apple juices (Rydzak et al., 2020). The pH values were reported by various studies ranged from 3.34 to 3.68 (Karaman et al., 2020) and from 3.39 to 3.77 (Nadulski et al., 2016). pH was recorded in the range of (2.90-3.64) and acidic value ranges from (0.1-0.23%). Giryn et al., (2004) also reported similar results as pH value of raw juices ranged from 3.39–3.77, and that of packed juices from 2.91-3.29. Chung and Hai-Jung's study consisted of the physio-chemical activities of ten collected commercial juice samples. The pH and acidity were (3.57, 13.1) respectively (Chung, Hai-Jung, 2012). Mehboob et al., (2023) reported high levels of acidity content (0.22%) in packed apple juices as compare to fresh apple juices (0.18%). Souci et al., (2005) also reported 0.74 g/100ml of organic acid in apple juice. Increase in pH is observed during fruit juice storage and also due to the loss of acidity (Sivakov, *et al*, 1990). Flavor of fruit juices also affected by acidity (Hussain, *et al*, 1993). Acidity for various fruit juices was analyzed by Akubor (1996) and suggested that acidity boost with long storage time for different juices.

Ash % illustrates organic and inorganic contents found in juices. The ash content of given apple juice samples was ranged from (0.05-0.12%). Highest ash contents are present in sample V samples I, VII found to have same ash content (0.10%) and samples II, III, IV, VIII lowest ash content is found in sample VI (0.05%) (Ayub et al., 2005). Mehboob et al., (2023) reported high levels of ash content (0.0573%) in fresh natural apple juices as compare to commercial packed apple juices (0.029%).

Protein is the vital constituent of all foods. The results indicate an insufficient amount of protein in apple juice. A high rate of protein was reported in apple juice sample VII (0.14%). Souci et al also reported 0.07 g/100ml of protein in apple juice. 0.08% crude protein was also reported by Mehboob et al., (2023).

Vitamin C (ascorbic acid) is the chief ingredient of fruits. It is complex to protect this vitamin during the manufacturing process of fruit juices. In the study of Kabasakalis and coworkers found vitamin C (Ascorbic acid) from 2.4 to 43 mg/100 ml of commercially available fruit juices (Kabasakalis et al., 2000). The current study showed highest level of ascorbic acid in samples V, VIII of apple juice, (11.8, 11.0mg/100g), whereas sample I shows the lowest ascorbic level (8.6 mg /100g) remaining samples ranged from (10.8-8.96 mg/100g). Souci et al., (2005) also reported 1.4mg/100ml of Vitamin C in apple juice.

The second largest components are carbohydrates such as glucose, fructose, and sucrose (Adou et al., 2012). Sugar plays a vital part in the process of fermentation. According to the results, these VIII samples of apple juice have total sugars in a range of (6.2-10.2%). Chung and Hai-Jung's studied physio-chemical activities of ten commercially available juice samples. The reducing sugar percentage was 57.58%. The reducing sugar percentage was 57.58%. (Chung, Hai-Jung, 2012). The concentration of reducing sugars is more than that of non -reducing sugars in the given apple juice samples. Samples contain more amount of reducing sugars glucose rather than non-reducing sucrose. According to the results reducing sugars found in samples ranges of (2.7-5.3%), while non-reducing sugars are found in a range of (3.3-4.9%).

According to Stanford cancer center (SCC,2008) another essential constituent of fruit juices is fibers. They play a significant role in controlling bowel movements and due to which reduce the threat of colon

cancer. Result shows that only three given samples of apple juice I, III, V contain a very fewer amount of fiber contents, i.e. (0.1%), while fiber content is totally absent in the remaining samples. Souci et al., (2005) also reported 0.77g/100ml of fiber in apple juice. Mehboob et al., (2023). Also reported 0.06% crude protein in fresh and commercially available apple juices.

Conclusion; The current research indicates that commercially available fruit juices vary in nutritional content, organic and inorganic components, fiber, pH, and acidity levels. The percentage of Moisture, pH and acidity were highest as compare to the standard parameters in most of samples. Mostly protein contents were not in maximum range in juices and maximum protein content was found in apple juice sample VII, (0.14%). Ascorbic acid was found higher from standard range in samples V, VIII, (11.8, 11.0mg/100g). All samples of apple juices fall within the standard range for total sugars, reducing sugars, and non-reducing sugars typically found in tetra pack juices. Each juice offers a unique combination of components. Government agencies like the Food Authority of Pakistan should conduct proactive assessments to monitor the chemical quality of fruit juices available in commercial market and raise public awareness about contaminated and adulterated juices.

Conflict of Interest; No conflict of interest

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